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ABSTRACT

To provide a differentiated characterization of autistic children's logical deficits, a non-verbal, microanalytic method designed for infants and young children was used. Subjects were 12 autistic children ranging in age from 5 to 7 years and a control group of 12 normal children ranging in age from 23 to 30 months. Subjects were given two classification tasks: a one-dimensional and a two-dimensional task. Each task began with a free-play condition followed by provoked sorting and modeling conditions. Autistic and control children were matched on the basis of their ability to sort classes based on similarity in a free-play condition of the one-dimensional task. Comparisons were then made on other aspects of their free-play activity and on their performance in the provoked and modeling conditions in both tasks. This paper reports results of a comparison of subjects' activities in the provoked sorting conditions. Autistic children were found to be greatly delayed in their logical development. They were unable to coordinate the construction of two classes simultaneously. Autistic children engaged in fewer relevant sorting placements than normal children. In contrast, however, when only the relevant sorting placements were considered, autistic children produced a higher percentage of correct classification placements than controls. Results suggest that the autistic children accommodated more to the classification structured of the objects to be sorted than did the normal children in the conditions containing objects with multiple perceptual attributes. Implications of the findings are discussed. (RH)

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SPONTANEOUS AND PROVOKED CLASS SORTING BEHAVIOR AMONG AUTISTIC AND NORMAL CHILDREN*

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A. Introduction

Autistic children have been described as having a central cognitive deficit. They are deficient in logical, abstract abilities and symbolization as assessed by IQ, sensory, and perceptual tests (Lockyer and Rutter, 1970). Cognitive-developmental assessments are needed to further specify these logical deficiencies. Such studies have been carried out primarily with verbal, psychotic children. They have been described as deficient in logical abilities and self-regulatory processes (Schmid-Kitsikis, 1973, 1976).

Autistic children's logical development is more difficult to assess due to their severe language disability (Rutter, 1978b). Autistic children have been administered classification tasks which require receptive language abilities. In these studies, the autistic children have been described as developmentally delayed on matching tasks (James, 1978) and resistant on discrimination tasks (Cowan et.

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al., 1965). Sensorimotor assessments have described both developmental delays (Curcio, 1978, Serifica, 1971, Sigman and Ungerer, 1981, Thatcher, 1976) and deficient symbol formation (Sigman and Ungerer, 1981, Thatcher, 1976) among autistic children. One study claims the delay is due to autistic children's failure to accommodate (Thatcher, 1976). On the contrary, a non-verbal training study (Lancy and Goldstein, 1982) claims that attentional and linguistic abilities interfere with task performance.

At issue is the nature of and functional sources of autistic children's logical deficits. The aim of the present study is to provide a more differentiated characterization of these deficiencies by utilizing a non-verbal, microanalytic method designed for infants and young children (Langer, 1980).

B. Subjects and procedure

The subjects included the target group, 12 autistic children ranging from ages 5 to 7 years, and the control group, 12 normal children ranging from ages 23 to 30 months. The autistic children, diagnosed in school evaluations, demonstrated the following symptoms: (1) social withdrawal (Kanner, 1973), (2) a severe language disorder (Kanner, 1973), (3) ritualistic and compulsive behavior (Rutter, 1978a) and (4) motility distortion (Cowan, 1978).

The children were given two classification tasks, a one-dimensional and a two-dimensional task. In the one-dimensional, additive task, the objects varied along three form dimensions. This yielded three classes of four objects each for a total of twelve

objects. In the two-dimensional, multiplicative task, the objects varied along three form dimensions crossed with two color dimensions. This yielded six classes of two objects each for a total of twelve objects.

The task objects were either solid, geometric objects, e.g. cylinders, square-columns and triangular columns, or realistic objects, e.g. cups, spoons and knives. Both the order of the tasks and the object type were counterbalanced across the subjects.

Each task began with a 2 1/2 minute free play condition, followed by a provoked sorting condition and then a modeling condition. Only the results from the provoked sorting conditions will be presented here. They include sorting by form in the Additive task and sorting by both form and color in the Multiplicative task.

In the provoked sorting conditions, the experimenter guided the child's activity towards class sorting. The experimenter sorted a few objects either spatially or into containers, presented the child with additional objects in random order and corrected the child's placement errors.

The procedure for matching the subject groups differs from most other comparative studies. Most studies match subject groups on the basis of a criterion, e.g. MA, IQ or chronological age, which is not strongly correlated with the field of cognitive development studied. The use of these external measures for matching purposes is problematic.

The method used here, therefore, was one which pairs the subject

groups on particular aspects of a cognitive domain and compares them on related aspects of this same domain. In this research, autistic and normal children were matched on one aspect of their classificatory activity and compared on other aspects of their activities in these same tasks. Specifically, the autistic and normal children were matched on the basis of their ability to sort classes based on similarity in the free-play condition of the one-dimensional task. Most of the autistic children were limited to organizing one class-consistent collection at a time. Those who constructed two overlapping, class- consistent collections, constructed them in successive temporal order. This indicates a failure to coordinate the construction of multiple, class-consistent collections and constitutes a vast developmental delay.

Each autistic child was paired with a normal child who performed at the same developmental level on this measure in the free-play condition of the one- dimensional task. Comparisons were then made on other aspects of their free-play activity and on their performance in the provoked and modeling conditions in both tasks. This paper reports on the results of a comparison of their activities in the provoked sorting conditions.

C. Results

In the provoked sorting conditions, the children engaged in a variety of actions when handed objects to sort. These actions were grouped into the following three categories: (1) placements of objects into piles or containers, (2) minor adjustments of objects in their

piles or containers, and (3) placements of objects outside of piles or containers. The sorting placements were considered relevant for scoring children's classificatory activity. The minor adjustments did not alter the classification accuracy of the placements and the non-sorting placements were considered extraneous activity.

A comparison was made between these three action categories in the provoked conditions using a 3x2x2 repeated measures analysis of variance. The normal children produced a higher percentage of sorting placements than the autistic children across all three task conditions ($F(1,18) = 16.02$, $p<.01$). The percentages of sorting placements produced are presented in column 1 of Table 1. In contrast, the autistic children produced a higher rate of both minor adjustments ($F(1,18) = 11.87$, $p<.01$) and non-sorting placements ($F(1,18) = 5.01$, $p<.05$) than the normal children across all three provoked conditions. The percentages of minor adjustments produced are in column 2 and of non-sorting placements produced are in column 3 of Table 1.

These findings suggest that normal children accommodated more to the task at hand as reflected in their higher sorting placement rate, than did the autistic children. Reciprocally, the autistic children engaged in more activity irrelevant to class sorting, i.e. minor adjustments and non-sorting placements.

The sorting placements were further analyzed in order to assess the relevant classificatory activity. The children's sorting placements were scored as either correct or incorrect based on whether objects were placed together with their class members.

There was a main subject effect using a 3x2x2 repeated measures

analysis of variance ($F(1,16) = 3.98$, $p=.06$). Autistic children produced more correct sorting placments than the normal children across all three conditions.

These results indicate that when we eliminate minor adjustments and non-sorting placements which are both irrelevant to class sorting, then autistic children produce a higher rate of correct class sorting than normal children. Thus, when sorting, the autistic children accommodated more than matched but younger normal children to the classification structure of the material.

There was no subject by task interaction in the three-way ANOVA on the rate of correct class sorting, probably because there was too much within group variability. However, when the means were plotted, an interaction was suggested (see Figure 1). This warrranted further analyses.

The rate of correct sorting was analyzed in each task using a 2x2 analysis of variance. The results support the interpretation of a subject by task interaction. The autistic children produced a higher percentage of correct classificatory placements than the normal children in both the Multiplicative form sorting condition ($F(1,18) = 3.41$, $p<.10$) and the Multiplicative color sorting condition ($F(1,18) = 6.17$, $p<.05$).

These results suggest that autistic children accommodated more to the objects' classification structure than the normal children in the conditions containing objects with multiple perceptual attributes.

Some of the autistic and normal children were able to complete

the provoked sorting by rudimentary alternating between classes, (e.g. alternating three objects in sequence). Recall that this more advanced procedure was missing from their spontaneous activity. In fact, the autistic children demonstrated a stronger trend toward alternating classifying than the normal children in both form sorting conditions. In the Additive form sorting condition, four autistic children alternate between classes while only one normal child does, and in the Multiplicative form sorting condition, four autistic children alternate between classes while no normal children do. In the Multiplicative color sorting condition the rate of alternating classifying is equivalent; two subjects in each group alternate between classes. The incidence of this advanced sorting process among one third of the autistic children as compared to isolated cases among the normal children, is a further indication that the autistic children surpass the normal children in their accommodation to the structured material.

D. Discussion

Autistic children were found to be greatly delayed in their logical development when assessed by their spontaneous performance in the free-play condition of the one-dimensional classification task. They were unable to coordinate the construction of two classes simultaneously. This difficulty in coordinating preoperations may contribute to developmental delays observed* in the logical domain (James, 1978, Lockyer and Rutter, 1970) and in symbol formation (Lockyer and Rutter,

*Note that Lancy and Goldstein's (1982) training study did not require the coordination of multiple classes in the classification task.

1970, Thatcher, 1976).

Autistic children were paired with younger normal children at their developmental level on this classification measure. When compared on their performance in three provoked sorting conditions, group differences emerged.

Autistic children engaged in fewer relevant sorting placements than normal children. This indicates a lower level of accommodation to the framework of the task and suggests a form of resistance to a socially structured situation, (cf. Cowan et. al., 1965). It is consistent with the general characterization that autistic children fail to accommodate (Thatcher, 1976) and may be an explanation for autistic children's attentional deficits (Lancy and Goldstein, 1982).

In contrast, when only the relevant sorting placements are considered, the autistic children produced a higher percentage of correct classification placements than the normal children. The autistic children accommodated more than the normal children on this measure.

While both groups include individuals whose structural level progresses beyond that in the free-play condition, the autistic children demonstrate a higher incidence of this advance. This provides further evidence of autistic children's accomodatory capacity when working within the task framework in response to the structure provided by the task materials. This indicates that providing a structured task can be a useful teaching technique with these children if the guidance stems from the objects rather than from the person/teacher.

Thus, a more circumscribed characterization of autistic children's failure to accommodate (Thatcher, 1976) is warranted. While they are less likely to follow the socially structured guidelines of the task than the normal children, they are more likely to follow the physical classification structure of the sorted objects. Autistic children appear to resist social forms of disequilibrium, but do accommodate to the positions of physical objects.

These divergent accommodatory trends lend further support to the claim (Slotnick, 1982) that a distinction needs to be made between social and physical sources of disequilibration and children's resulting forms of accommodation in Piaget's (1975) equilibration theory. Furthermore, this differentiation should be made clinically. Relevant activity should be separated from irrelevant, i.e. resistant, activity prior to assessing autistic children's performance on cognitive measures.

Finally, the advance of the autistic children over the normal children in successful class sorting in both Multiplicative conditions indicates that the presence of multiple object features in the Multiplicative task did not hinder the autistic children's performance. This is contrary to findings on perception, which indicate that autistic children have trouble flexibly responding to and coordinating multiple stimuli (Lovaas, 1977). It suggests that in a cognitive, structured task, the graphic qualities of multiplicative classifications (Inhelder and Piaget, 1964) may, in fact, enhance autistic children's ability to sort classes.

Table 1

Mean Percentages of Sorting Placements, Minor Adjustments and Non-sorting Placements by Subject Group

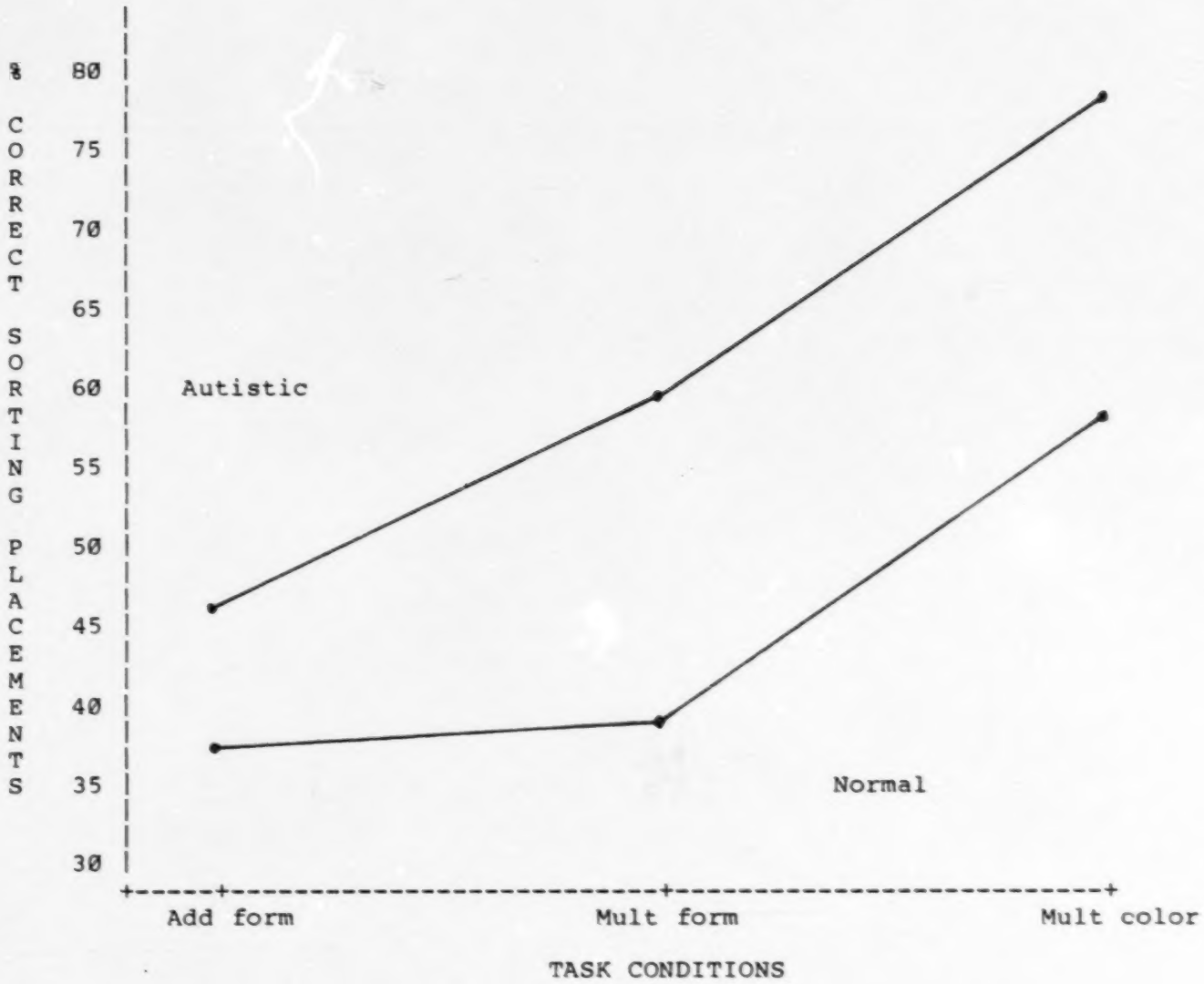
Subject Group	Activity Categories		
	Sorting Placements	Minor Adjustments	Non-sorting Placements
Autistic	45.0	16.0	40.3
Normal	76.2	2.6	21.2

Note. The means are collapsed across object conditions.

Figure 1

Mean Percentages of Correct Sorting Placements

by Subject Groups by Task



Note. The means are collapsed across object conditions.

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